



Introduction

If your habits resemble those of average Americans, you generate about 4.6 pounds of solid trash per day. This adds up to big trouble for the environment. Americans are generating waste products faster than nature can break them down and using up resources faster than they can be replaced.

How can we find ways to meet our current economic and social needs without compromising the ability of our children, and our children's children, to do the same? Our success will depend on understanding the difference between

- Sustainable practices: practices that provide ongoing economic and social benefits without degrading the environment.
- Unsustainable practices: "quick fixes" that fill an immediate need for resources. Over time, however, these practices deplete or damage natural resources so they cannot be used or enjoyed by future generations.

Solid Waste

Every year, the United States generates approximately 230 million tons of "trash"--about 4.6 pounds per person per day. Less than one-quarter of it is recycled; the rest is incinerated or buried in landfills. With a little forethought, we could reuse or recycle more than 70 percent of the landfilled waste, which includes valuable materials such as glass, metal, and paper. This would reduce the demand on virgin sources of these materials and eliminate potentially severe environmental, economic, and public health problems.

Could We Bury It?

According to the U.S. Environmental Protection Agency, many of the country's landfills have been closed for one or both of these two reasons:

- They were full.
- They were contaminating groundwater. The water that flows beneath these deep holes is our drinking water. Once groundwater is contaminated, it is extremely expensive and difficult, and sometimes even impossible, to clean it up.

Could We Burn It?

Yes and no. Incineration does generate energy, but at a cost--it may release toxins into the air and

create ash that requires disposal in hazardous-waste landfills, and that takes us back to our starting point: Cities are running out of places to put their trash.

Could We Pay Someone to Take It?

Not likely. As our population grows, former outlying areas are becoming bedroom communities, and their residents mount stiff opposition to plans for expanding existing landfills or creating new ones, even in return for some perks. And as local and state government officials cope with the costs and problems of their own waste disposal, they are less willing to import other communities' waste and the pollution it generates. So where does this leave us?

Possible Solutions for Solid Waste

We do have some sustainable solutions, options that let us meet our current needs and provide for future generations as well. Our most promising alternatives are waste reduction and recycling.

Waste Reduction: Stop Throwing Things Out

A simple and obvious choice is to cut back on the amount of waste by using and throwing out less in the first place. Some states have adopted regulatory strategies to discourage dependence on landfills. In 1990, for example, California enacted a law that established a baseline for the amount of solid waste its cities and towns send to landfills. By 1995, that amount was to be reduced by 25 percent; by the year 2000, by 50 percent. California now diverts more than 25 percent of its waste, resulting in disposal of approximately 33 million tons per year. Such heavy cuts are usually accomplished by recycling.

Waste Reduction: Use Less Packaging

Packaging is one of the major sources of waste paper and plastics. According to EarthWorks Groups, it accounts for approximately one-third of all the garbage Americans send to landfills. Packaging should be minimal. Its production should be environmentally clean and it should be made up of materials that can be reused or recycled repeatedly. Some packaging is purposely elaborate to make the contents more attractive--cosmetics are notorious for this. Smart buyers can support the use of environmentally friendly packaging by purchasing products with minimal packaging or with packaging made of recycled or recyclable materials.

Recycling: Turning Waste Material into Raw Material

Recycling works, and it does so in several ways. It reduces the monetary and environmental costs of landfilling and incineration. It substitutes used materials for virgin materials, thereby reducing the demand for natural resources. It conserves energy. And it creates jobs in the community.

Many U.S. communities now actively recycle. Common programs include

- Curbside recycling containers. The community provides containers in which individual families deposit such materials as newspapers; glass bottles and jars; tin and aluminum containers; plastic bottles and bags; mixed waste paper (cardboard, phone books, magazines, junk mail, office paper, brown bags); and used motor oil. The community arranges for curbside pickup and delivery to a recycling facility.
- Drop-off recycling zones. Groups of large recycling bins are installed on public property in one or more locations throughout the community.
- Recycling centers. The community provides the center itself and encourages residents to drop off or sell refuse materials there.

- Green waste diversion and composting programs. Leaves, grass clippings, and other organic waste materials are composted and used to enrich soil or as mulch or landfill cover.

Is there a downside to recycling?

Opponents of recycling argue that recycled goods are more expensive and that recycling takes away needed jobs. However, as more consumers choose to purchase recycled products and as recycling technology improves, the cost of these goods goes down, making them more competitive in the marketplace. And while diverting materials from landfills does take away disposal jobs, these jobs are often replaced by jobs in the growing recycling industry.

Hazardous Waste

Hazardous waste presents immediate or long-term risks to humans, animals, plants, or the environment. It requires special handling for detoxification or safe disposal. In the U.S., hazardous waste is legally defined as any discarded solid or liquid that

- contains one or more of 39 carcinogenic, mutagenic, or teratogenic compounds at levels that exceed established limits (including many solvents, pesticides, and paint strippers);
- catches fire easily (such as gasoline, paints, and solvents);
- is reactive or unstable enough to explode or release toxic fumes (including acids, bases, ammonia, and chlorine bleach); or
- is capable of corroding metal containers such as tanks, drums, and barrels (such as industrial cleaning agents and oven and drain cleaners).

The EPA has a list of more than 500 specific hazardous wastes.

Who's Responsible?

Businesses such as metal finishers, gas stations, auto repair shops, dry cleaners, and photo developers produce many toxic waste products. These by-products include sulfuric acid, heavy metals found in batteries, and silver-bearing waste, which comes from photo finishers, printers, hospitals, schools, dentists, doctors, and veterinarians. Heavy metals, solvents, and contaminated wastewater result from paint manufacturing. Photo processing also creates organic chemicals, chromium compounds, phosphates, and ammonium compounds. Even cyanide can be a by-product, resulting from electroplating and other surface-treatment processes.

If you think industry is the only source of hazardous waste, you may be surprised. There is hazardous household waste as well. For example, do you use any of the following items?*

automotive products, such as gasoline, antifreeze, and batteries
oil-based paints and thinners
pool chemicals
pesticides, herbicides, and other garden products
household cleaning products

* There are nontoxic alternatives to many of these products that, when disposed of, do not constitute hazardous waste.

Possible Solutions for Hazardous Waste

Basically, there are two approaches to addressing the challenges of hazardous waste. One is waste management, and the other is waste prevention.

Waste Management: Minimizing the Impact

Waste management is based on the premise that a high volume of waste is the unavoidable result of our modern lifestyle and of economic development. The objective is therefore to manage waste and minimize its impact. Waste-management strategies include burying or incinerating waste or exporting it to some other state or country.

Waste Prevention: Minimizing the Volume

Preventing waste is a kind of "front-end" approach; it views waste either as material that should not be created in the first place or as a potential resource that can be used as raw material for another process. The fundamental objectives of this approach are to reduce the use of new raw materials and energy and to recycle waste products back into usable resources.

According to the National Academy of Sciences, the waste-prevention approach should have the following hierarchy of goals:

1. Reduce waste and pollution.
2. Reuse as many things as possible.
3. Recycle and compost as much waste as possible.
4. Chemically or biologically treat or incinerate waste that can't be reduced, reused, recycled, or composted.
5. After the first four goals have been met, bury what is left in state-of-the-art landfills or above-ground vaults. .

Sewage

Solid waste going into landfills has a serious impact on the environment, but it's not our only disposal concern. Wastewater also needs to be managed in order to reduce threats to public health, safety, and the environment. Wastewater can consist of industrial waste, human waste (or sewage), or runoff from rainwater.

All of the wastewater produced by a city eventually ends up in a river, lake, or ocean. On its way, this wastewater flows through a sewage treatment plant. In conventional sewage treatment plants, bacteria remove up to 90 percent of biodegradable organic wastes before the sewage moves to a sedimentation tank, where remaining solids and microorganisms settle as sludge. The sludge is incinerated, dumped in the ocean or a landfill, composted, or used as fertilizer. The remaining wastewater, still containing oxygen-demanding wastes, suspended solids, nitrates, phosphates, and toxic metal compounds, may pass through additional advanced sewage treatment before being discharged to the river, lake, or ocean.

Treating Sewage: A Costly Proposition

Conventional sewage treatment is an expensive process that uses a lot of energy. During periods of heavy use or rapid growth, increases in wastewater volume add to that expense. As a taxpayer, you may be asked to fund short-term measures to cope with temporary crises, or to approve longer-term capital outlays for upgrades to your community's sewage system and treatment plant.

Besides wastewater from sewage, there is urban runoff: water that flows down streets and into storm drains. In some coastal communities, urban runoff flows untreated into the ocean. When this happens, the runoff also transports contaminants such as gasoline, oil, paint, heavy metals, pesticides, human and animal waste, and trash. These contaminants pose a severe threat to the ocean as an economic, recreational, and biological resource as well as to the community's residents and economy.

Possible Solutions for Sewage

Seeking a more natural and less expensive approach to sewage treatment, the city of Arcata, California has implemented an effective low-tech alternative: an artificial wetlands waste treatment plant. Currently, more than 150 cities and towns in the United States use natural and artificial wetlands to treat sewage.

In the first stage of Arcata's system, sewage is held in sedimentation tanks where the solids settle out as a sludge that is removed and processed for use as fertilizer. The remaining wastewater is pumped into oxidation ponds; here, as in conventional treatment plants, bacteria break down the waste. About one month later, the water is released into a series of artificial marshes, where it is further filtered and cleansed by reeds, cattails, and bacteria. The purity of the water increases as it is subjected to the wide range of acidities that result naturally from daily cycles of photosynthesis.

Although the water is clean enough at the end of this process to be discharged directly into the bay, California state law requires it to be chlorinated, to ensure that all pathogens have been destroyed. So Arcata chlorinates the water and then dechlorinates it before sending it into the bay. In some communities in states that don't require chlorination, the water is diverted at this point to fish hatcheries. The remaining nutrients in the water provide food for the fish, thus contributing to a source of food for people.

As an additional bonus, the Arcata marshes and lagoons serve a wildlife sanctuary and city park, providing habitats for otters, seabirds, and other marine animals and attracting many tourists.

Global Efforts

Many cities around the world are beginning to develop and implement "sustainability" projects. These projects typically include strategies for reducing waste, often by using waste as raw material for building homes, generating energy, or nourishing crops, for example. One effective waste-management program can be found in Copenhagen, Denmark.

Managing Urban Waste: Copenhagen, Denmark

Copenhagen has developed a comprehensive program for managing urban waste. The goals of the program are ambitious:

- 58 percent of the city's household, commercial, and industrial waste is to be recycled
- 24 percent is to be incinerated
- 18 percent is to be deposited in a landfill

Danish municipalities have the authority to regulate all waste generated by their local commercial, construction/demolition, and industrial sectors. Throughout the 1980s, they exercised this authority mainly by requiring that waste producers to pay a tax for waste disposal. The waste was shipped to

centralized sorting plant; often the wastes would mix during shipment, making the sorting process difficult.

To increase the impact of the waste-management system, the Copenhagen City Council adopted new regulations in 1991 requiring that waste producers separate all waste at the source of generation. Hazardous waste must be separated from waste meant for incinerators or landfills and must be either recycled or treated at specialized facilities. In addition, waste generators are required to reduce the volume of waste sent to incinerators or landfills by introducing new technologies, processes, or recycling measures.

As a result of these regulations, the number of landfills in use has been reduced from 30 to 3. Today more than 50 percent of the city's commercial, industrial, and demolition waste is recycled. Furthermore, about 50,000 tons of combustible waste, previously deposited in landfills, are now incinerated in plants that convert waste to energy.

Possible Solutions for Global Efforts

Building a Sustainable City: Santa Monica, California

One of the most comprehensive community environmental efforts in the world is Santa Monica's "Sustainable City Program." This program addresses the underlying causes of environmental problems, not just the symptoms, and takes into account both the long-term and the short-term impact of decisions. While the program primarily focuses on the environment, it also addresses broader social, economic, and quality-of-life issues such as affordable housing, public spaces, and education.

The program established broad policy goals in four major areas: resource conservation; transportation; pollution prevention and public health protection; and community and economic development. In addition to the broad goals, 16 related sustainability indicators were developed to measure the program's progress.

One of Santa Monica's current goals is to reduce landfilled solid waste to 50 percent of its 1990 level by the year 2000. The city's efforts to reduce its waste generation include the following:

- Residential curbside collection of recyclables and recycling drop-off zones.
- Recycling programs at schools and commercial sites.
- Concrete, asphalt, scrap metal, and tire recycling.
- A volume-based billing system for waste disposal to encourage people to reduce their waste generation.
- Administrative and purchasing policies designed to help reduce waste and encourage the purchase of products made from recycled materials.
- Using electronic technologies to reduce paper waste.
- Incorporating old tires into the asphalt used for street paving.
- Developing new waste-reduction methods for street and sidewalk repairs.

Increasing Awareness of Household Hazardous Waste: Peterborough, Ontario

The city of Peterborough in Ontario, Canada, sponsors a waste collection program that helps citizens properly handle and dispose of household hazardous waste and encourages them to reduce this kind of waste by using safer alternatives.

Traditionally, people have disposed of hazardous household waste such as paint and propane cylinders along with their regular refuse, and all of it has gone into landfills. This practice creates health and safety risks for garbage collectors and has resulted in the leaching of toxic chemicals from landfills into soil and groundwater. Additionally, used motor oil is often indiscriminately dumped, and certain materials with recovery potential, such as batteries, are thrown away.

To address these problems Peterborough has hosted special collections for hazardous household waste since 1989. These events are held at convenient community sites. The city provides shipping containers and material-handling equipment, and chemical-handling specialists are on hand.

Among the items collected are propane cylinders, which can be recycled and lead-acid batteries, which can be used for metal recovery. Motor oil to be recycled is collected in large drums. Paint is taken away in its original containers to a paint-recycling facility, where it is sorted by color and composition for filtering and blending. In 1992, the city used the event to dispose of outdated prescription drugs that volunteers picked up from local pharmacies and delivered to the disposal sites. Residents participating in the program receive information on environmentally friendly alternatives to many of the materials that they bring for disposal.

Using Landfills for Energy: Texas

In Texas, the cities of Austin, Houston, and Lewisville are leading efforts to use landfills as resources for energy production.

Organic garbage such as plants, wood, and other vegetable matter decomposes in landfills, a process that produces carbon dioxide, methane, and other gases. Because landfill gas contributes to the formation of smog and may cause explosions if uncontrolled, state and federal regulations require that landfill owners capture and dispose of it.

At some landfills, methane gas is collected, cleaned, converted into electricity, and delivered to the city's power grid. One facility in Texas uses this process to generate 5.4 megawatts of electricity, which powers more than 6,500 homes.

The Future

Sustainability is the intelligent use of our resources--natural and technological--to meet our communities' needs both today and in the future. People worldwide are beginning to recognize that a healthy, functioning community relies on a healthy environment.

Pollution and overuse of resources can affect everything from the health of children to the availability of raw materials. Increasingly, we are realizing the importance of not only meeting environmental regulations but also taking extra steps to reduce waste, prevent pollution, and conserve resources. As more communities choose to pursue sustainability, successful environmental programs will continue to emerge. These programs will become models on which to base global efforts to protect and restore the environment.

Each individual has a role in building a sustainable future. At home, school, and work, we can make changes that will help preserve our resources for future generations. Many individuals and communities have already begun--find out how you can do your part.